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Liberal trade policy and food insecurity across the income distribution: an observational analysis in 132 countries, 2014–17

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Summary

Background Eradicating food insecurity is necessary for achieving global health goals. Liberal trade policies might increase food supplies but how these policies influence individual-level food insecurity remains uncertain. We aimed to assess the association between liberal trade policies and food insecurity at the individual level, and whether this association varies across country-income and household-income groups.

Methods For this observational analysis, we combined individual-level data from the Food and Agricultural Organization of the UN with a country-level trade policy index from the Konjunkturforschungsstelle Swiss Economic Institute. We examined the association between a country's trade policy score and the probability of individuals reporting moderate-severe or severe food insecurity using regression models and algorithmic weighting procedures. We controlled for multiple covariates, including gross domestic product, democratisation level, and population size. Additionally, we examined heterogeneity by country and household income.

Results Our sample comprised 460 102 individuals in 132 countries for the period of 2014–17. Liberal trade policy was not significantly associated with moderate-severe or severe food insecurity after covariate adjustment. However, among households in high-income countries with incomes higher than US$25 430 per person per year (adjusted for purchasing power parity), a unit increase in the trade policy index (more liberal) corresponded to a 0·07% (95% CI –0·10 to –0·04) reduction in the predicted probability of reporting moderate-severe food insecurity. Among households in the lowest income decile (<$450 per person per year) in low-income countries, a unit increase in the trade policy index was associated with a 0·35% (0·06 to 0·60) increase in the predicted probability of reporting moderate-severe food insecurity.

Interpretation The relationship between liberal trade policy and food insecurity varied across countries and households. Liberal trade policy was predominantly associated with lower food insecurity in high-income countries but corresponded to increased food insecurity among the world's poorest households in low-income countries.

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See **Comment** page e985

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Introduction

Food insecurity is a root cause of many of today's most pressing global health challenges and prevents millions of individuals from reaching their full social and economic potential.[1] Food insecurity has serious and long lasting effects on health and can result in malnutrition, wasting, and premature mortality.[2,3] Even in contexts where these severe outcomes are rare, food insecurity is associated with a higher risk of cardiovascular disease, poor mental health, and poor management of long-term health conditions.[4–9] And yet, the world is facing a series of challenges to eradicating food insecurity. The proportion of the global population with chronic food deprivation declined substantially in 2005–15, from 14·5% in 2005 to 10·6% in 2015.[10] However, this downward trend has stalled, and the COVID-19 pandemic, climate change, population growth, and declining biodiversity might undermine the previous progress.[11]

Eradicating food insecurity is, therefore, a key priority in the global health agenda. The UN's Sustainable Development Goals (SDGs), adopted by 193 countries in September, 2015, called on countries to "end hunger" and "achieve food security" (SDG 2) by 2030.[12] Food security exists "when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food" and thus it is also essential to ensuring healthy lives for all (SDG 3).[13] Achieving this will require concerted action to address the complex determinants of food insecurity, and international organisations have long promoted liberal trade policy as one effective approach.[14–16]

However, theoretical and empirical studies to date have reached divergent conclusions about the relationship between liberal trade policy and food insecurity.[15,16] Liberal trade policy typically affects multiple sectors and can positively or negatively influence individual food insecurity through changes to food supplies, prices, and affordability. For example, research indicates that liberal trade policy in the food and agricultural sectors can increase access to food imports, lower food prices, smooth

Research in context

Evidence before this study

We searched Scopus, Google Scholar, and PubMed for studies published in English up to Dec 18, 2018, investigating the relationship between liberal trade policy and food insecurity using the search terms "trade policy", "trade reforms", "trade liberalization", "nutrition", "food security", and "food insecurity" applied to keywords, abstracts, and titles. We also examined the bibliographies of existing reviews of trade policy, nutrition, and health for additional studies. Our searches identified divergent hypotheses about the nature and expected direction of trade policy effects on food insecurity. Additionally, varying methods of conceptualising and ultimately measuring both trade policy and food insecurity have produced different findings. Studies have predominantly used country-level food insecurity proxies (eg, food supply and famines) or did not correct for potential trade policy covariates (eg, gross domestic product). Other studies identified increased food supplies and reduced food price volatility in response to agricultural trade liberalisation. These studies might not capture food insecurity outcomes in response to cross-sector trade liberality, because availability, supplies, and prices at the local or aggregate level might not translate into consumption. Furthermore, the socioeconomic consequences of liberal trade policy can have varying effects on food budgets and access across different country-income and household-income groups. We did not identify any studies that did a systematic global analysis of the relationship between cross-sector liberal trade policy and individual-level food insecurity outcomes in different household-income and country-income groups.

Added value of this study

We combined novel data and methods to undertake the first systematic analysis, to our knowledge, of the relationship between liberal trade policies and probability of individuals reporting food insecurity across country-income and household-income groups. We combined rich microdata collected in the Gallup World Poll from 460 102 people across 132 countries with country-level data on the degree of liberal trade policy across multiple sectors from the Konjunkturforschungsstelle Swiss Economic Institute for the period of 2014–17. We used cross-national regression models, an algorithmic weighting procedure, and a series of additional tests to assess whether our results are explained by other processes.

Our results advance the debate about food insecurity under different trade regimes by revealing marked distributional complexities in this relationship. More liberal trade policy was, on average, associated with a lower probability of reporting moderate-severe or severe food insecurity, but this association was not robust once we adjusted for potential covariates. In high-income countries, greater trade liberality was associated with a lower probability of reporting moderate-severe food insecurity among individuals with household incomes higher than US$4300 per person per year (adjusted for purchasing power parity). However, trade liberality corresponded to a higher probability of food insecurity among individuals in the lowest income decile (<$450 per person per year) in low-income countries.

Implications of all the available evidence

Our results corroborate previous suggestions that food insecurity is lower among most income groups in high-income countries with more liberal trade regimes. However, we found that liberal trade policy corresponded to lower food affordability and access among some of the world's poorest households in low-income countries. Therefore, our results are cause for both optimism and concern among policy makers, donors, international institutions, and physicians worried about food insecurity, and are especially relevant for those developing trade and food insecurity policies. Our results highlight the need to consider the distributional complexities in the impact of trade reforms on food insecurity. Complementary measures might be necessary to ensure widespread improvements in food security under liberal trade regimes. Additionally, our results point toward a crucial and urgent need for research that evaluates the effects of trade policy changes on food insecurity among different socioeconomic groups.

domestic food supply volatility, and expand domestic food production.[17–19] Liberal policy in other sectors might also reduce food insecurity through increased wages and employment.[15] Yet a resurgence of anti-trade politics in the USA and Europe has generated renewed interest in which socioeconomic groups benefit from liberal trade policy and whether disadvantaged socioeconomic groups have long-term losses.[20] However, little is known about distributional differences in the effects of trade policy on food insecurity.[21,22]

Socioeconomic conditions exert a strong influence on food security, and thus some argue that liberal trade policies spanning multiple sectors might have varying effects on food insecurity among different groups according to whether and how their socioeconomic circumstances differ. For example, research indicates that high-income countries generally benefit economically from liberal trade policies but some lower-income countries do not yield increased trade flows and income growth from these policies because of labour market rigidities, weak property rights, and poor infrastructure.[23] The economic effects of trade can also vary within countries. Increased competition and falling prices for some goods has resulted in increased wages for some individuals but lower wages and job losses for others working in the least competitive firms or sectors.[24,25]

Therefore, liberal trade policies spanning multiple sectors might reduce food insecurity in some contexts, but

these benefits might not accrue universally. Affluent households—with wage-earners who work in more competitive sectors—might have increased access to diverse and cheaper food supplies as well as increased food affordability through wage or job growth, especially in high-income countries that are better able to harness the economic benefits of trade. By contrast, some argue that deteriorating economic circumstances could undermine food affordability among less affluent households, whose wage-earners often work in less competitive sectors and lack the resources to withstand income shocks.[15,16]

Overall, the net direction of changes to food insecurity and the socioeconomic groups affected might partly depend on how the impact of different food prices in response to liberal trade policy are exacerbated or offset by socioeconomic circumstances that affect food affordability. For example, declines in food affordability through changing incomes or employment might offset the benefits of reduced food prices and increased food access, resulting in no effect on food insecurity. One long-standing hypothesis is that liberal trade policy could increase food insecurity among individuals without the resources, land rights, or knowledge required to compete with subsidised, large-scale, multinational producers.[26–29] In low-income and lower-middle-income countries, poor individuals are far more likely to lack these capacities, suggesting that the world's poorest households could be among those exposed to trade's deleterious economic effects, potentially leading to reductions in food affordability and access.[26]

Demand for countries' food exports and the extent to which land is used for non-food resources can also vary under different trade regimes.[26,30] According to this view, trade integration might lead to increased staple food prices and reduce food affordability. Others have argued that food price and supply volatility can also occur in more integrated markets because of fluctuating demand and crises elsewhere.[31] Again, the world's poorest households, according to a report by the Food and Agriculture Organization (FAO) of the UN, could be the most acutely affected by fluctuating demand, crises, and food price rises, because they spend a higher proportion of their income on food than more affluent households and do not have the surplus income required to absorb price shocks.[10,15]

The existing literature has yet to explore these complexities because the necessary data were not available. Hence, the links between liberal trade policy and food insecurity remain disputed, despite recognition of the need to assess how outcomes vary in different conditions by use of indicators that capture the multiple dimensions of food insecurity.[15,16] Here, we expand on previous work by doing—to our knowledge—the first empirical test of whether individuals living in countries with more liberal trade policies are less likely to be food insecure, and whether this association varies across country groups and household-income groups.

Methods

Data and measures

For this observational analysis, we used individual-level data on household food insecurity and socio-demographic characteristics from the Gallup World Poll (GWP) for the years 2014–17, made available by a license from the FAO. The GWP is a stratified random sample poll done in over 140 countries since 2005. In 2014, the FAO funded the inclusion of its Food Insecurity Experience Scale (FIES), a new global measure of individual food insecurity. FIES contains eight yes or no questions spanning the multiple dimensions of food insecurity (appendix, pp 2–3), where a yes response indicates the respondent reported that they experienced difficulties in obtaining or affording sufficient food, on a consistent basis, during the preceding 12 months. Several studies have assessed the validity of FIES and concluded that it is the only internationally comparable measure of micro-level food insecurity that has internal and construct validity.[32] We recoded responses across the eight questions into two binary categories of food insecurity: moderate-severe food insecurity, capturing a yes response to at least four questions; and severe food insecurity, capturing yes responses to at least seven questions.[33]

For the **Gallup World Poll** see https://www.gallup.com/analytics/232838/world-poll.aspx

See **Online** for appendix

Our trade policy measure was a subcomponent of the Konjunkturforschungsstelle (KOF) Globalisation Index.[34] We used the *de jure* measure of trade integration, which captures policies that impede or promote trade flows between countries and for which data are available across countries over several years. This index allowed us to measure the general degree of trade liberality across sectors, capturing the interacting and potentially modifying influence of cross-sector trade liberality. Crucially, this measure should not be interpreted as specific to any particular sector, such as agriculture. Additionally, this measure captures different trade regimes due to both historic and recent policy changes.

After merging the GWP and KOF data with additional covariate data, we excluded cases with missing individual-level and country-level data (additional details are presented in the appendix, pp 2–12).

Statistical models

We estimated separate logistic regression models examining the association between the liberal trade policy index and the two binary outcomes: moderate-severe and severe food insecurity. We tested for heterogeneity by incorporating interaction terms between trade policy and country-income classification and a three-way interaction between trade policy, country-income classification, and household-income per person per year (net of welfare support, adjusted for differences in purchasing power).

Both food insecurity and trade policy might be caused by a third factor, such as gross domestic product (GDP). However, valid instruments for liberal trade policy are difficult to identify. Briefly, we aimed to reduce potential measurable sources of bias using two statistical

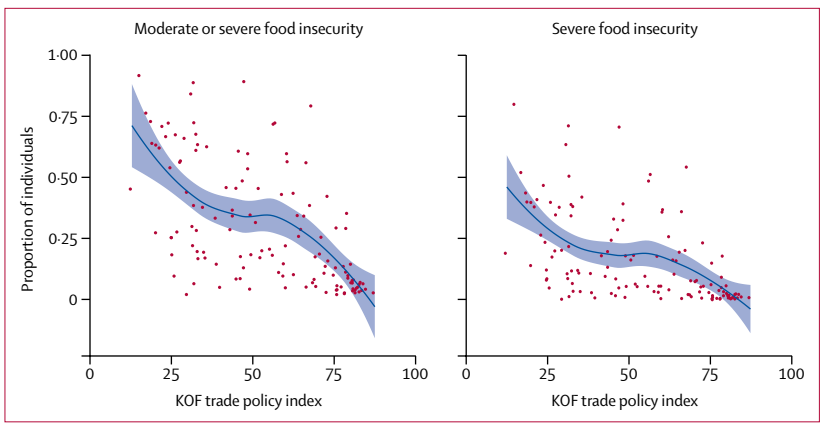

Figure 1: **Association between KOF trade policy index and proportion of individuals reporting food insecurity**
Shaded area represents 95% CI. Lowess smoother, unconditional association between country-average proportion of country respondents reporting food insecurity and country-average KOF trade policy index score in all years (bandwidth 0·8). See appendix (pp 2–4) for details of trade policy and food insecurity data sources and measurement. KOF=Konjunkturforschungsstelle Swiss Economic Institute.

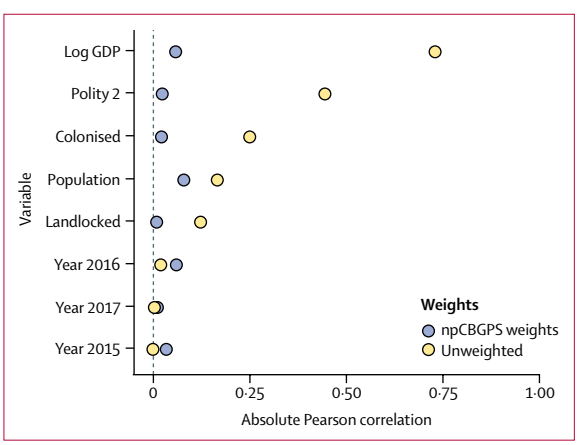

Figure 2: **Absolute Pearson correlation between trade policy covariates and trade policy pre-weighting and post-weighting**
The npCBGPS developed by Fong and colleagues[35] is estimated such that it minimises the Pearson correlation between covariates and treatment assignment and maximises the prediction of treatment assignment, avoiding iterations between model fitting and balance checking (appendix pp 13–18). GDP=gross domestic product. npCBGPS=non-parametric covariate balancing generalised propensity scores. Polity 2=degree of democratisation.

procedures. We incorporated potential country-level confounders as controls: GDP per capita, degree of democracy, population size, being a landlocked country, whether a country had been colonised, and dummy years capturing unobserved period differences. We estimated pooled models because we had an insufficient number of repeat observations and within-unit variation to estimate panel generalised method of moments or fixed-effects models.

Additionally, we reweighted observations using non-parametric covariate balancing generalised propensity scores (CBGPS).[35] This non-parametric algorithm identifies country-weights that, when applied to each unit, minimise the correlation between trade policy and its covariates while simultaneously maximising treatment prediction. We then applied these weights in the model fitting process. We subsequently built on these baseline models in doubly robust specifications incorporating individual-level and macro-level controls and non-parametric CBGPS weights simultaneously.[35] All models testing for interactions with household income at the individual-level incorporated individual-level controls: age, sex, education, employment status, and marital status. We did additional tests to assess the robustness of our results. Full details of all statistical procedures are provided in the appendix (pp 13–18). Analyses were done in R, version 3.5.2.

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Our final analytical sample comprised 460 102 individuals spanning up to 132 countries for the period of 2014–17. 26·7% of respondents included in the sample reported moderate-severe food insecurity, a value that varied from country to country. In low-income countries, 58·1% of respondents reported moderate-severe food insecurity compared with 35·9% in lower-middle-income, 23·2% in upper-middle-income, and 7·8% in high-income countries. Food insecurity also varied according to whether individuals were at the bottom or the top of the global household income distribution. Among households in the highest income decile in high-income countries, rates of moderate-severe food insecurity were 1·9%, whereas rates among households in the lowest income decile were 73·8% in low-income countries.

We observed a negative association between liberal trade policy and the proportion of a country's respondents reporting moderate-severe and severe food insecurity (figure 1). However, this association could plausibly be explained by trade policy and food insecurity covariates. Re-weighting observations with use of non-parametric CBGPS weights substantially reduced covariate imbalance (figure 2), reducing the mean absolute Pearson correlation between covariates and trade policy from 0·22 (pre-weighting) to 0·05 (post-weighting). When we used these weights to correct for covariate imbalance, we observed no clear association between more liberal trade policy and an individual's odds of having moderate-severe or severe food insecurity (table). We observed also substantial variation in our general estimates. For example, Argentina and Sri Lanka had approximately 5% higher food insecurity rates than those predicted given their trade policy scores, whereas Slovenia, Ecuador, and

Bahrain had approximately 5% lower food insecurity rates than those predicted.

To assess differences between country-income groups, we estimated an interaction model and calculated the average difference in the predicted probability of food insecurity per unit increase in trade liberality (the average marginal effect [AME]) in each income group.[36] None of the AMEs was significantly different from zero (figure 3) although, when comparing the coefficients for high-income and low-incomes countries, we found that the AME was 0·35% (95% CI 0·34–0·36) higher in low-income countries than in high-income countries.

Next, we explored within-country heterogeneity because some income groups might benefit more than others; once aggregated, this might account for the null effects observed in figure 3. The correlation between liberal trade policy and food insecurity varied both between countries and across the income distribution (figure 4). A unit increase in the trade policy index (indicating a more liberal trade policy) was associated with a 0·35% (95% CI 0·06–0·60) increase in the predicted probability of reporting moderate-severe food insecurity among households in the lowest income decile (<US$450 per person per year; adjusted for purchasing power parity) in low-income countries. Moving up the income distribution, the AME declined in size but remained positive among households earning up to $2760 per person per year; 94·7% of respondents in low-income countries had incomes lower than this threshold. The AME was not significant at higher incomes.

The pattern in low-income and lower-middle-income countries differed from those in upper-middle-income and high-income countries (figure 4). Among upper-middle-income countries, none of the AMEs were significant. In high-income countries, the AME was not significant among poor households earning up to $4300 per person per year; 9·5% of respondents had incomes below this level. However, a unit increase in trade liberality was associated with a reduction in food insecurity among households with a per capita annual income higher than $4300, corresponding to 90·5% of respondents in high-income countries. For household incomes larger than $25 430 per person per year (figure 4), a unit increase in the trade policy index (more liberal) corresponded to a 0·07% reduction (95% CI –0·10 to –0·04) in the predicted probability of reporting moderate-severe food insecurity.

We did a series of additional tests to explore whether our results were stable across model specifications, including a placebo test that examined an outcome we would not expect to be affected by trade policy: whether people would help a stranger (appendix pp 24–30). We found no significant associations, giving our results more face validity.[37] We also estimated doubly robust models incorporating both macro-level controls and non-parametric CBGPS weights. Additionally, we originally estimated pooled models because we had an insufficient number of repeat observations and within-unit variation to estimate panel generalised method of moments or fixed-effects models. However, as an additional check, we re-estimated our models incorporating country fixed effects to test whether the broad pattern of our results was generally consistent. Furthermore, our original models did not incorporate a country's arable land area as a control because data were only available for approximately half of the countries. We did an additional test in which we included this variable and re-estimated our models.

The precise income groups that had a predicted rise and fall in food insecurity in low-income and high-income countries varied in some of the additional tests (appendix pp 25–30). As expected, the results from the

	Moderate-severe food insecurity	Severe food insecurity
Model with no controls or weights	0·96 (0·96–0·98)	0·97 (0·96–0·98)
Model with covariate controls	1·00 (0·98–1·01)	1·00 (0·98–1·01)
Model with npCBGPS* weights	1·00 (0·99–1·02)	1·00 (0·99–1·02)

Data are odds ratio (95% CI); n=460 102. npCBGPS=non-parametric covariate balancing generalised propensity scores. *This model adjusts for covariates of trade policy and food insecurity by re-weighting observations to minimise the association between trade policy and gross domestic product per capita, degree of democratisation, being a former colony, being landlocked, population size, and survey year; additional details of covariate measurement, sample composition, and statistical procedures are shown in the appendix (pp 2–4).

Table: **Association between liberal trade policy and odds of reporting moderate-severe or severe food insecurity**

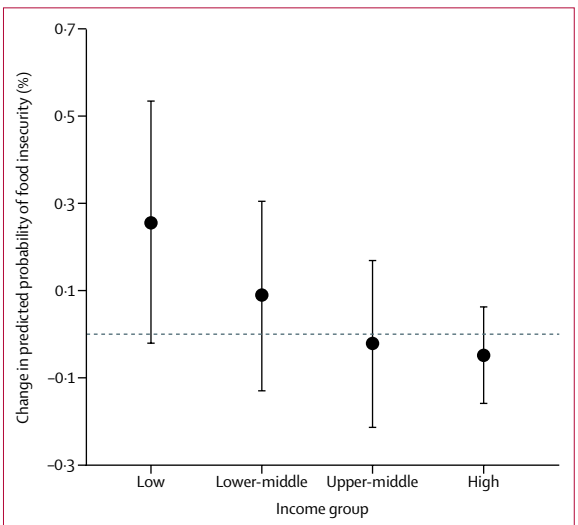

Figure 3: **Change in predicted probability of reporting moderate-severe food insecurity per unit increase in trade policy index across country income classifications**

Change in predicted probability of reporting moderate-severe food insecurity per unit increase in trade policy index (indicating more liberal trade policy) among countries in different income groups. Error bars denote 95% CI. A figure showing probability of reporting severe food insecurity is shown in the appendix (p 22).

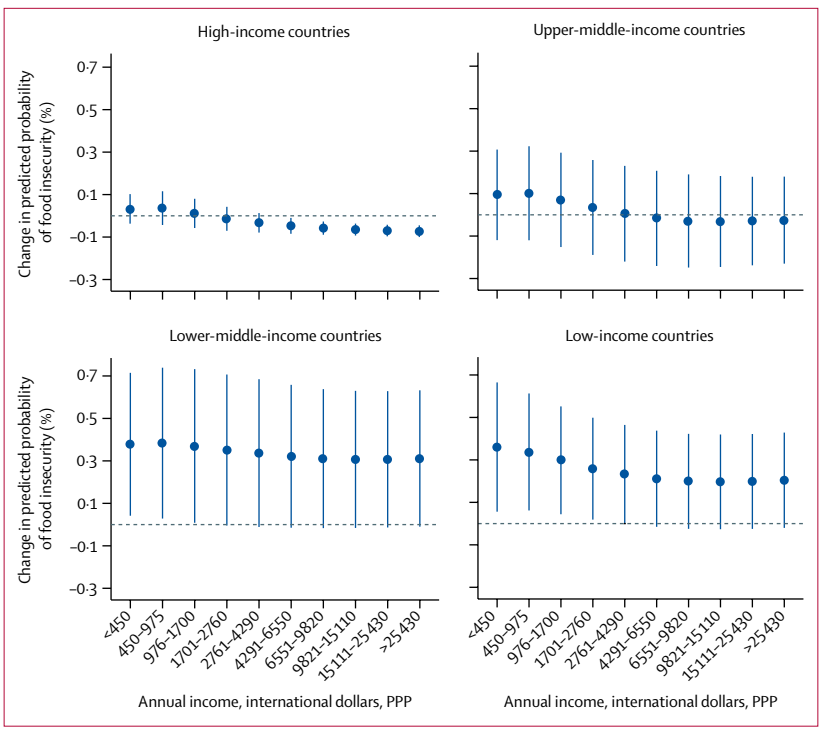

Figure 4: **Predicted change in the probability of reporting moderate-severe food insecurity per unit increase trade policy score by country-income and household-income group**

Change in predicted probability of reporting moderate-severe food insecurity per unit increase in trade policy index (indicating more liberal trade policy) among households of different income levels in different income groups. Error bars denote 95% CI. Annual income converted from local currency into US$, adjusted for differences in purchasing power. A figure showing changes in predicted probability of reporting severe food insecurity is shown in the appendix (p 23). PPP=purchasing power parity.

fixed-effects models had wider 95% CIs because of the reduced sample size. However, the pattern of the results was broadly consistent with our main models.

Discussion

Our analysis has identified distributional differences in the relationship between liberal trade policy and food insecurity. Drawing on a global analysis of unique microdata spanning 132 countries in 2014–17, we found that the negative association between trade policy and the probability of reporting food insecurity was not robust to covariate adjustment. However, this global estimate masked significant variation. In high-income countries, more liberal trade policy was associated with lower food insecurity among individuals who lived in households earning more than $4300 per person per year (approximately 90·5% respondents). By contrast, more liberal trade policy had no statistically identifiable association with food insecurity among poorer households in high-income countries. In low-income countries, poor households earning less than $2760 per person per year (94·7% of respondents) were more likely to be food insecure where trade policy was more liberal, whereas trade liberality had no statistically identifiable association among those earning higher incomes.

Our study has important limitations, some reflecting data availability and the inability to do randomised experiments. First, some trade policy covariates are difficult to measure, such as privatisation reforms. We have attempted to control for and minimise the risk that our results are explained by alternative processes by estimating models addressing different sources of bias, including covariate confounding (using regression controls), covariate imbalance (non-parametric CBGPS weights), and time-invariant heterogeneity (fixed-effects). However, we were unable to identify a suitable instrument for liberal trade policy and rule out all confounders, and our data do not allow for definitive causal conclusions. Future quasi-experimental studies should further investigate our study's findings, and our results highlight the need for future research in this area. Nevertheless, our findings provide new evidence of significant and clear complexities in the association between trade policy and food insecurity by use of detailed microdata. This improves our understanding of the nature of the relationship between trade policy and food insecurity and presents an important finding for policy makers and practitioners to consider—alongside context-specific information and existing evidence—when developing trade and food insecurity policies.

Second, our analysis used a unique dataset of individual-level food insecurity that captured outcomes within a limited time period, and whether our results are representative in the long-run remains unclear. Outcomes in the short-run might vary over time due to changing industry structures and labour mobility in response to liberal trade.[38] Additionally, our results showed differences in food insecurity levels under different trade regimes, and that these might reflect both policy changes in previous periods and contemporaneous reforms. More longitudinal and quasi-experimental research is necessary to assess the effect of trade reforms on multidimensional food insecurity measured at the individual level and associated mechanisms, including prices.

A third limitation concerns the generalisability of our findings to agricultural trade policy and other sector-specific measures. Our results did not pertain to agricultural trade liberalisation, specifically. Indeed, one interpretation of our paper is that any benefits from sector-specific policies, including those affecting agriculture, might be offset by liberal policies in other sectors that create socioeconomic changes that serve to undermine food security. Additionally, we were unable to fully capture export taxes, and trade policy might also have different implications in the context of trade wars. Industry-specific tariff increases in response to bilateral disputes have escalated in the past few years and might adversely affect some poor countries.[39] More research is necessary to assess the effect of recent and ongoing trade disputes.

Fourth, it is necessary to understand how liberal trade policies affect nutrient intake and associated outcomes.

Consumption of unhealthy products such as sugar has increased in response to liberal trade policy in some contexts, and this can occur even if households remain food insecure.[40] Our results, together with previous findings, suggest that liberal trade policy could be an institutional driver of food consumption patterns related to both under-nutrition and over-nutrition in low-income countries.

More research is also necessary to identify precisely which of the mechanisms that we have discussed could explain our results, why some groups have increased food insecurity in countries with more liberal trade regimes whereas others have reductions, whether additional sources of variation exist, and how benefits might be equalised. As we have shown elsewhere, these questions are under-explored in the general literature on trade policy and health and are an important priority for future research.[22,41] Examining specific case studies where food insecurity was higher or lower than that predicted given the country's trade policy score could also be fruitful.

Important variations might also exist between high-income countries according to their welfare system. Indeed, liberal trade policy might best enable food insecurity reductions where policies serve to mitigate harms and ensure shared benefits, because social transfers could minimise some of the social and economic dislocation that occurs as a result of trade. Potentially effective complementary policies include infrastructural investment and active re-employment programmes, in addition to instruments specifically targeting food insecurity, such as food subsidies. The rules and agreements that govern trade conditions might also be an important target for intervention by, for example, removing subsidies in high-income countries that render poor countries unable to compete with imports or by ensuring that labour market protections remain adequate.[26]

These limitations notwithstanding, what do our results imply about how to reduce food insecurity and associated health outcomes in different contexts? Although our research is observational and primarily assesses food insecurity outcomes under different trade regimes, our results give policy makers grounds to consider how evenly shared the impact of trade reforms on food insecurity are likely to be in different contexts. Hence, more research is certainly needed to estimate the causal effects of trade policy changes on food insecurity. Nevertheless, our results are important to consider, given the divergent findings to date and the paucity of evidence concerning the relationship between dynamic changes in trade policy and multidimensional individual food insecurity indicators.

Therefore, our findings might be cause for both optimism and concern for policy makers and physicians concerned with reducing food insecurity. We found that liberal trade policy is, in the right conditions, associated with lower food insecurity and thus might also help to alleviate associated health consequences. According to our results, these conditions are predominantly observed in high-income countries, where affluent households (by global standards) had lower food insecurity under more liberal trade regimes. By contrast, people in high-income countries who are on low incomes by global standards (eg, those living on less than $5–10 per day in the USA),[42] did not necessarily benefit from liberal trade regimes in terms of food insecurity, suggesting that benefits from food price declines might be offset by material losses, or that some of these individuals gain but others lose out.

Additionally, when we looked at low-income countries and focused on the world's poorest households, we found that food insecurity was higher where trade policy was more liberal. Although trade liberality, especially in the agriculture sector, might well yield increases in food access by increasing food imports, our findings suggest that these improvements do not extend to the poorest households or are offset by deteriorating economic circumstances that undermine food affordability. What makes this particularly salient is that these are also the households in which the most severe health consequences of food insecurity are likely to be felt.[12] Hence, policy makers might need to work across sectors to ensure that policies in different areas serve to reinforce—rather than undermine— the possible benefits of trade integration.

Liberal trade policy has been cited as an engine for reducing food insecurity (SDG 2) and thus improving health (SDG 3). Our study suggests that policy makers need to consider the complexities in whether liberal trade policies yield widespread benefits. Developing inclusive approaches to liberal trade policy might be crucial to ensuring that trade liberality yields the benefits we identified while avoiding food insecurity and hunger among the world's poorest households.

Contributors

PB and AR conceptualised and designed the study. AR, RL, and VT obtained the study data. PB developed the statistical models, did the statistical analysis, and synthesised the statistical results. AR contributed to developing the statistical models, reviewed the study methods, and validated the statistical results. PB and AR wrote the original drafts of the manuscript. PB, AR, RL, and VT contributed to editing and revising the manuscript.

Declaration of interests

We declare no competing interests.

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